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| 10/549,851 | 09/23/2005 | Kazuhide Hasebe | 33082M274 | 3704 |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/549,851 | HASEBE ET AL. | |
| | Examiner | Art Unit | |
| | REEMA PATEL | 2812 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *03 November 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *2-7,9-16 and 19-22* is/are pending in the application.

4a) Of the above claim(s) *2,3,13 and 14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *4-7,9-12,15,16 and 19-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 September 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

This action is in response to an amendment filed 11/3/08.

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 4-5, 9-10, and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bolscher et al. (U.S. 6,468,903 B2; hereinafter 'Bolscher') in view of Goto et al. (U.S. 2003/0010354 A1; hereinafter 'Goto') and Yoo (U.S. 2002/0102859 A1).

3. Regarding claims 4 and 21, Bolscher discloses a method comprising:

- A deposit-removing step of removing a deposit stuck to an inside of a film-forming unit (col 2, line 58-62);
- A purging step of purging an inside of the reaction chamber by supplying into the reaction chamber a nitrogen-including gas that includes nitrogen and that is capable of being activated (col 2, line 63 - col 3, line 4),
- Wherein the purging step has a step of nitriding a surface of a member in the reaction chamber by activating the nitrogen-including gas (col 2, line 63 - col 3, line 4).

4. Furthermore, Bolscher discloses the film to be deposited on the substrate, which is later specified as silicon nitride (col 3, lines 36-39), also deposits in the interior of the

film-forming unit (col 1, lines 21-23). Bolscher also discloses the purging step is performed at a temperature (850°C) and a pressure (66 Pa) (col 3, lines 6-12).

5. Yet, Bolscher does not disclose the following:

a) The deposit-removing step occurs by supplying aqueous HF at a predetermined pressure range.

b) Loading and unloading the object at a pressure and temperature, wherein the temperature is less than that of during the purging step.

6. Regarding (a), Bolscher discloses that the deposit-removing step occurs by supplying aqueous HF (col 2, lines 58-62) and not a fluorine-containing gas. However, Goto discloses removing various residues from the walls of a film-forming unit by supplying molecular fluorine gas ($F_2$) ([0009], [0012]). Such a process has the advantage of removing residue without using a solvent and hence producing less waste. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Bolscher with using $F_2$ gas, as taught by Goto, so as to remove deposits from the film-forming unit while producing less waste.

7. Goto does not disclose performing the cleaning step at a pressure of 100-400 torr. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to select a pressure of 100-400 torr, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233.

8. Regarding (b), Bolscher discloses loading and unloading the object to be processed (col 4, lines 23-30) but does not disclose temperatures and pressures for these steps. However, Yoo discloses a processing sequence in which wafers are loaded and unloaded from a chamber at vacuum pressure ([0010]) and a low temperature ([0026]). Selecting such a pressure and temperature allows for easier wafer handling during the loading and unloading steps. It would have been obvious to one having ordinary skill in the art at the time the invention was made to select a temperature of 300°C, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Bolscher with loading and unloading the wafers at a normal pressure and temperature less than the purging temperature (850°C), as taught by Yoo, so as to ease wafer handling.

9. Regarding claim 5 and 9, Bolscher discloses the nitrogen-including gas is ammonia (col 2, lines 33-34) and the member in the reaction chamber consists of quartz (col 2, lines 29-31).

10. Regarding claim 10, Bolscher, Goto, and Yoo disclose the nitrogen-including gas is an ammonia gas (Bolscher: col 2, lines 33-34) and also discloses that the film-forming apparatus can form a silicon nitride film (Bolscher col 3, lines 37-39). Yet, they are silent with regards to the process gas that can be used to form such a film. However, the examiner takes Official Notice that the use of ammonia and a Si-containing gas as

process gases in forming a silicon nitride film is well known in the art (see for example, Agusta et al. (U.S. 3,865,652), col 3, lines 45-53). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Bolscher, Goto, and Yoo with forming the silicon nitride film using a process gas comprising ammonia and a silicon-including gas so as to use readily available silicon nitride-forming precursors.

11. Regarding claim 22, Bolscher discloses the thin film is a silicon nitride film (col 3, lines 36-39).

12. Claims 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bolscher et al. (U.S. 6,468,903 B2; 'Bolscher') as modified by Goto et al. (U.S. 2003/0010354 A1; 'Goto') and Yoo (U.S. 2002/0102859 A1) as applied to claim 4 above, and further in view of Kato et al. (U.S. 2002/0106909 A1; "Kato").

13. Regarding claims 6-7, Bolscher, Goto, and Yoo disclose a nitride-deposit removing step and that the film forming unit is heated to approximately 900°C during a purging step (col 3, lines 6-12) but do not disclose the following:

a) The pressure during the nitride-deposit removing step is approximately 150 torr and the temperature is 300°C.

b) The temperature and pressure are controlled by a controller which is connected to a heat unit and to different gas supply units.

14. Regarding (a), Bolscher, Goto, and Yoo disclose a nitride-deposit removing step but do not disclose that the pressure is approximately 150 torr and the temperature is

300°C. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to select a pressure of approximately 150 torr and temperature of 300°C, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233.

15. Regarding (b), Bolscher, Goto, and Yoo do not disclose a controller which controls the parameters of gas flow, temperature and pressure. However, Kato discloses a single controller device connected to a microprocessor which controls gas inlet flows, temperatures, and pressures in a chamber device during various steps in a processing sequence ([0039]). The advantage of a controller is the ability to change processing conditions with ease. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Bolscher, Goto, and Yoo, with a controller, as taught by Kato, so as to modify processing conditions with ease.

16. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bolscher et al. (U.S. 6,468,903 B2; 'Bolscher') in view of Goto et al. (U.S. 2003/0010354 A1; 'Goto'), Yoo (U.S. 2002/0102859 A1), and Kato et al. (U.S. 2002/0106909 A1; "Kato").

17. Regarding claim 11, Bolscher discloses a method comprising:

- A deposit-removing step of removing a deposit stuck to an inside of a film-forming unit (col 2, line 58-62);

- A purging step of purging an inside of the reaction chamber by supplying into the reaction chamber a nitrogen-including gas that includes nitrogen and that is capable of being activated (col 2, line 63 - col 3, line 4),
- Wherein the purging step has a step of nitriding a surface of a member in the reaction chamber by activating the nitrogen-including gas wherein the interior of the film-forming unit is increased to approximately 850°C (col 2, line 63 - col 3, line 4).

18. Furthermore, Bolscher discloses the film to be deposited on the substrate, which is later specified as silicon nitride (col 3, lines 36-39), also deposits in the interior of the film-forming unit (col 1, lines 21-23). Bolscher also discloses the purging step is performed at a temperature (850°C) and a pressure (66 Pa) (col 3, lines 6-12).

19. Yet, Bolscher does not disclose the following:

c) The deposit-removing step occurs by supplying aqueous HF at a predetermined pressure range.

d) Loading and unloading the object at a pressure and temperature, wherein the temperature is less than that of during the purging step.

e) A controller controls temperatures, pressures, and gas inlet flows and is connected to a heating unit and gas supply unit.

20. Regarding (c), Bolscher discloses that the deposit-removing step occurs by supplying aqueous HF (col 2, lines 58-62) and not a fluorine-containing gas. However, Goto discloses removing various residues from the walls of a film-forming unit by supplying molecular fluorine gas ($F_2$) ([0009], [0012]). Such a process has the

advantage of removing residue without using a solvent and hence producing less waste. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Bolscher with using $F_2$ gas, as taught by Goto, so as to remove deposits from the film-forming unit while producing less waste.

21. Goto does not disclose performing the cleaning step at a pressure of 100-400 torr. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to select a pressure of 100-400 torr, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233.

22. Regarding (d), Bolscher discloses loading and unloading the object to be processed (col 4, lines 23-30) but does not disclose temperatures and pressures for these steps. However, Yoo discloses a processing sequence in which wafers are loaded and unloaded from a chamber at vacuum pressure ([0010]) and a low temperature ([0026]). Selecting such a pressure and temperature allows for easier wafer handling during the loading and unloading steps. It would have been obvious to one having ordinary skill in the art at the time the invention was made to select a temperature of 300°C, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Bolscher with loading and unloading the wafers at a

normal pressure and temperature less than the purging temperature (850°C), as taught by Yoo, so as to ease wafer handling.

23. Regarding (e), Bolscher does not disclose a controller which controls the parameters of gas flow, temperature and pressure. However, Kato discloses a single controller device connected to a microprocessor which controls gas inlet flows, temperatures, and pressures in a chamber device during various steps in a processing sequence ([0039]). The advantage of a controller is the ability to change processing conditions with ease. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Bolscher with a controller, as taught by Kato, so as to modify processing conditions with ease.

24. Claims 12, 15-16 and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishibashi (U.S. 6,942,892 B1) in view of Kato et al. (U.S. 2002/0106909 A1; "Kato").

25. Regarding claims 12 and 15, Ishibashi discloses a film forming unit comprising:

a) A cleaning-gas supplying unit that supplies directly into the reaction chamber a cleaning gas that includes fluorine (col 5, lines 18-25; col 7, lines 16-19; col 8, lines 28-35);

b) A material gas supplying unit that supplies directly into the reaction chamber a material gas that is capable of being activated (col 5, lines 18-25; col 6, lines 18-22);

c) An activating unit (3, Fig. 1) that activates the material gas, the activating unit being a heating unit (col 6, lines 18-22);

d) A nitriding unit (30, Fig. 1) that nitrides a surface of a member in the reaction chamber by controlling the activating unit so as to activate the material gas (col 5, lines 37-45).

e) A controlling unit capable of controlling a flow of nitrogen-including gas ('flow controller'; col 5, lines 28-31), and the processing temperatures ('electric current'; col 5, lines 37-45) and pressures ('exhaust system 11'; col 5, lines 33-36) during various steps in the process.

26. Regarding (a)-(b), Fig. 1 of Ishibashi illustrates combining the cleaning gas and material gas before entering the chamber. However, Ishibashi further discloses that the cleaning gas may be introduced through a different route than that of the material gas, for example through a nozzle (col 7, lines 16-19). Hence, in such a case, the cleaning gas supply and material gas supplying units can be thought to each individually supply their respective gases directly into the film forming unit.

27. Yet, Ishibashi does not disclose that the controller is connected to the heating unit and nitrogen-including-gas supply unit. In Ishibashi, the controller consists of multiple apparatuses (see above). However, Kato discloses a single controller device which controls gas inlet flows, temperatures, and pressures in a chamber device during various steps in a processing sequence ([0039]). The advantage of such a system is that changes to multiple processing conditions can be effected quicker when a controller consists of a single device. Therefore, it would have been obvious to one having

ordinary skill in the art at the time the invention was made to modify the invention of Ishibashi with a single controller unit, as taught by Kato, so as to be able to control multiple processing conditions with more ease.

28. Regarding claim 16, Ishibashi indicates that the apparatus comprises a gas inlet to allow gases to enter the chamber. The limitation that "the nitrogen-including gas is ammonia, dinitrogen monoxide or nitric oxide" is not given patentable weight because a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987) (MPEP 2114).

29. Regarding claim 19, Ishibashi discloses the heating unit is capable of heating the inside of the reaction chamber (col 5, lines 37-45; col 6, lines 4-12). The phrase, "wherein the heating unit heats...to a range of 600°C to 1050°C" is not patentable weight because a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987) (MPEP 2114).

30. Regarding claim 20, Ishibashi discloses a pressure adjusting unit (col 5, lines 33-36). The phrase, "a pressure-adjusting unit...that maintains [the pressure]...at a range of 133 Pa to 53.3 kPa" is not patentable weight because a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed

does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987) (MPEP 2114).

***Response to Arguments***

31. Applicant's arguments with respect to claims 4-7, 9-12, 15-16, and 19-22 have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to REEMA PATEL whose telephone number is (571)270-1436. The examiner can normally be reached on M-F, 8:00-4:30 ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Garber can be reached on (571)272-2194. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Examiner, Art Unit 2812
1/30/09

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